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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/790,759
Filing Date: March 03, 2004
Appellant(s): MARUYAMA, EIJI

Hosang Lee
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 02/02/2010 appealing from the Office action mailed 07/17/2009.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

(I) Applicant's Admitted Prior Art (AAPA), Background of the Invention, Page 2, Lines 1-19, and also figure 7.

(II) Neerinck et al., "Depth profiling of thin ITO films by grazing incidence X-ray diffraction", Thin Solid Films 278 (1996) pp 12-17.

(III) Adurodija et al., "Effect of Sn doping on the electronic transport mechanism of indium-tin-oxide films grown by pulsed laser deposition coupled with substrate irradiation", J. Appl. Phys. 88 (2000) pp 4175-4180.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 8-11, 14 and 19-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 8 and 19 add the limitation "wherein said two (222) peaks include a first peak having an intensity (I_1) (about 2.5) and a second peak having an intensity (I_2) (about 5.5) and the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is at least 0.48 and around 0.5," which is not supported by the original disclosure as filed. The original specification does not provide any support as to whether intensity ratio is "at least 0.48". The phrase "at least 0.48" is an exclusionary proviso which excludes any values less than 0.48, and there is no disclosure of "the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is at least 0.48 and around 0.5" being specifically contemplated in the specification as originally filed.

2. Claims 8-11, 14, and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (hereafter "AAPA") in view of Neerinck et al. ("Depth profiling of thin ITO films by grazing incidence X-ray diffraction," Thin Solid Films 278 (1996) pp12-17), and further in view of Adurodija et al. ("Effect of Sn doping on the electronic transport mechanism of indium-tin-oxide films grown by pulsed laser deposition coupled with substrate irradiation," J. Appl. Phys. 88 (2000) pp 4175-4180).

Regarding claims 8, 14 and 19, AAPA discloses (See Background of the invention; pages 2, lines 1-19; see also fig. 7) a photovoltaic device (fig. 7; page 2, lines 1-19) comprising:

- a first conductivity type or n-type single-crystalline silicon semiconductor substrate (n-type single-crystalline silicon substrate 101; fig. 7; page 2, lines 1-19) having a front surface (top surface on which i-type amorphous silicon layer 102 is disposed) and a back surface (surface on which back electrode 106 is disposed; see fig. 7) and receiving light incident from the side of said front surface;
- a substantially intrinsic first amorphous silicon semiconductor layer (i-type amorphous silicon layer 102; fig. 7; page 2, lines 1-19) formed on said front surface (top surface; see fig. 7) of said single-crystalline silicon semiconductor substrate (101), the substantially intrinsic first amorphous silicon semiconductor layer (102) consisting of a single layer (see fig. 7);
- a second conductivity type or p-type second amorphous silicon semiconductor layer (a p-type amorphous silicon layer 103; fig. 7; page 2,

lines 1-19) formed on said first amorphous silicon semiconductor layer (102); and

- a transparent conductive film (transparent conducting film 104; fig. 7; page 2, lines 1-19) consisting of indium-tin-oxide (ITO; page 2, lines 5-6), formed on said second amorphous silicon semiconductor layer (103),
    - wherein a collector (collector 105; fig. 7; page 2, lines 9-13) is formed on the transparent conductive film (104).

However, AAPA is silent as to the indium oxide layer having (222) plane orientation with two (222) peaks in said indium oxide layer, wherein said two (222) peaks include a first peak having an intensity (I_1) and a second peak having an intensity (I_2) and the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is at least 0.48 and around 0.5.

Neerinck discloses a double-layer structure transparent conductive film (see abstract) for use in optoelectronic application. Neerinck further discloses that the transparent conductive film includes an indium oxide layer (ITO film) (see abstract) having (222) plane orientation with two (222) peaks in said indium oxide layer, wherein said two (222) peaks include a first peak having an intensity (I_1) (about 2.5) (see fig. 1) and a second peak having an intensity (I_2) (about 5.5) (see fig. 1) and the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is ~ 0.4545 (2.5/5.5=0.4545) (see fig. 1 of Neerinck).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the transparent conductive film of Neerinck in the

photovoltaic device of AAPA because of its relatively low resistivity and high transmissivity to visible light (1:1-4 of Neerinck).

AAPA in view of Neerinck teaches that the ratio (I_1/I_2) is around 0.4545 and Neerinck further teaches that increasing the incidence angle (ω) increases the high-angle peak intensity (4:16-19) and decreasing the incidence angle (ω) decreases the high-angle peak intensity. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have performed routine experimentation by varying the incidence angle such that the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is optimized to allow for a layer with relatively low resistivity and high transmissivity to visible light as desired by AAPA in view of Neerinck (1:1-4 of Neerinck), since it has been held that discovering an optimum value for a result of effect variable involves only routine skill in the art (MPEP 2144.05 II (b)).

However, AAPA in view of Neerinck fails to disclose whether said indium oxide layer contains Sn, and the content of Sn with respect to indium in said indium oxide layer is at least about 2 percent by weight and not more than about 7 percent by weight.

Adurodija teaches a series of composition for ITO films that may be used in "many optoelectronic applications, including flat panel displays and solar cells" (Introduction, first paragraph). Adurodija shows in Figure 4a that the carrier concentration of these films increases with weight % of Sn from 0-6 wt. % and then either decreases of levels off from 6-10 wt. % Sn. Thus, Adurodija et al. show in this figure that the maximum carrier concentration for these films occurs around 6 wt. % Sn. Adurodija et al. disclose in first paragraph of the introduction that high carrier

concentration and low resistivity are optimal for use in solar cell applications as transparent conductors.

It would have been obvious to one of ordinary skill in the art at the time of the invention to choose a composition of the tin oxide layer used as the transparent conductive layer in the device of AAPA in view of Neerinck that is around 6 wt. % Sn as instructed by Adurodija in order to optimize the carrier concentration of the film.

Regarding claims 9 and 20, AAPA in view of Neerinck further discloses that said (222) peaks in Figure 1 of Neerinck et al. include: a first peak having an X-ray diffraction angle, 26, of about 30.1 + 0.1 degrees, and a second peak having an X-ray diffraction angle, 2e, of about 30.6 + 0.1 degrees.

Regarding claims 10 and 11, AAPA in view of Neerinck further discloses that the ratio (I_1/I_2) of the intensity of said first peak (I_1 = 2.5, in arbitrary units, according to Figure 1 of Neerinck et al.) to the intensity of said second peak (I_2 = 5.5, in arbitrary units, according to Figure 1) is ~ 0.4545.

(10) Response to Argument

1. Rejection Under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement.

Claims 8-11, 14 and 19-20

On page 5 of Appeal Brief dated 02/02/2010, Appellant argues that the "Examiner asserted that the limitations of claims 8 and 19 regarding "said two (222) peaks includes a first peak having an intensity (I_1) and a second peak having an intensity (I_2) and the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of

said second peak is around 0.5 excluding 0.46 [sic]" is not supported by the original disclosure as filed, and the original disclosure allegedly does not provide any support as to whether the intensity ratio is "at least 0.48."

The Examiner respectfully disagrees. Firstly, Examiner notes that the Appellant erroneously looked at the Office Action dated 02/19/2009 in preparing the Appeal Brief instead of Office Action dated 07/17/2009. Pending claims does not require the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak to be "around 0.5 excluding 0.46", but rather requires the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak to be "at least 0.48 and around 0.5." The Examiner's statement was as follows:

> Claim 8 and 19 add the limitation "wherein said two (222) peaks include a first peak having an intensity (I_1) (about 2.5) and a second peak having an intensity (I_2) (about 5.5) and the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is at least 0.48 and around 0.5," which is not supported by the original disclosure as filed. The original specification does not provide any support as to whether intensity ratio is "at least 0.48". (Page 4 of Office Action dated 07/17/2009).

In paragraph bridging pages 5 and 6 of Appeal Brief, Appellant argues that instant disclosure provides support for "the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is at least 0.48 and around 0.5." Applicant further refers to figure 6 and page 26, lines 6-14 of the Application as filed and states that the cell output (P_{max}) has a maximum value when the peak intensity ratio is at least 0.48 and around 0.5, and therefore the instant specification provides support for "the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is at least 0.48 and around 0.5."

The Examiner respectfully disagrees. Although Appellant is correct and figure 6 of instant application shows that the cell output is maximum at around 0.48, instant claims do not require a peak intensity ratio at which the cell output (P_{max}) has a maximum value. What the claims require is that "the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is at least 0.48 and around 0.5." The phrase "at least 0.48" is an exclusionary proviso which excludes any values less than 0.48, and there is no disclosure of "the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is at least 0.48 and around 0.5" being specifically contemplated in the specification as originally filed. On the contrary, page 8 of Appellant's specification states that "the ratio (I_1/I_2) of the intensity (I_1) of the first peak to the intensity (I_2) of the second peak is preferably at least about 0.07 and not more than about 0.9" (page 8, lines 1-4) and "the ratio (I_1/I_2) of the intensity (I_1) of the first peak to the intensity (I_2) of the second peak is more preferably at least about 0.25 and not more than about 0.75" (page 8, lines 5-9). See also page 6 of instant invention which shows the intensity ratio varies from 0.07 to 0.9. See also pp. 25, line 7 through pp. 28, line 2 of instant invention which shows the intensity ratio is open to any values from 0.07 to 0.9, but never mentions the intensity ratio to be at least 0.48, i.e., exclude any values less than 0.48. Therefore, instant specification by no means wished to exclude any values less than 0.48.

2. Rejection Under 35 U.S.C. § 103(a) as being unpatentable over AAPA, Neerinck and Adurodija.

Claims 8-11, 14 and 19-20

On pages 6-7 of Appeal Brief dated 02/02/2010, Appellant argues that Neerinck shows that the intensity ratio of two peaks is 0.4545, and therefore Neerinck fails to disclose "the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is at least 0.48 and around 0.5". The Appellant further goes on to argue that the changing the value of the incidental angle ω does not change the relative intensity ratio of the first peak intensity (I_1) to the second peak intensity (I_2), but the number of peaks, and therefore the intensity ratio of the two peaks can be optimized by controlling value of the incidental angle ω as shown by the Examiner.

The Examiner respectfully disagrees. Neerinck explicitly teaches that increasing the incidence angle (ω) increases the high-angle peak intensity (4:16-19) and decreasing the incidence angle (ω) decreases the high-angle peak intensity ("*Increasing ω leads to a relative increase of the high angle peak intensity...the high-angle peak has a higher peak intensity than the low angle peak (Fig. 1)*" – page 13, right column, lines 16-19 of Neerinck). Hence, one skilled in the art realizes that increase in the incidence angle (ω) would increase the high-angle peak intensity, and therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have performed routine experimentation by varying the incidence angle such that the ratio (I_1/I_2) of the intensity (I_1) of said first peak to the intensity (I_2) of said second peak is optimized to allow for a layer with relatively low resistivity and high transmissivity to visible light as desired by AAPA in view of Neerinck (1:1-4 of Neerinck), since it has been held that discovering an optimum value for a result of effect variable involves only routine skill in the art (MPEP §2144.05 II(b)).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/G. M./

Examiner, Art Unit 1795

Conferees:

/Jennifer K. Michener/

Supervisory Patent Examiner, Art Unit 1795

/Anthony McFarlane/